

CLAIMS:

What is claimed is:

1. A process of preparing an mixed catalyst system, comprising:
 - (a) combining a High MFR Catalyst with an activator and a support to form an activated High MFR catalyst system; and
 - (b) combining
 - (i) a diluent comprising a mineral or silicon oil with the activated High MFR catalyst system to form a first support slurry; followed by combining a Low MFR Catalyst with the first support slurry; or
 - (ii) a diluent comprising a mineral or silicon oil and a Low MFR Catalyst to the activated High MFR catalyst system.
2. The process of Claim 1, wherein the High MFR catalyst is a cyclic bridged metallocene; the cyclic bridged metallocene characterized in that it is capable of producing polyethylene with an MFR of 50 or more when activated and is the only catalyst present in a reaction mixture that includes ethylene monomers and is subjected to a gas phase polymerization; and wherein the Low MFR catalyst is a bridged metallocene; the bridged metallocene characterized in that it is capable of producing polyethylene with an MFR of less than 50 when activated and is the only catalyst present in a reaction mixture that includes ethylene monomers and is subjected to a gas phase polymerization.
3. The process of claim 1, wherein the activated supported High MFR catalyst system is formed by combining the components in (a) in a first diluent having a boiling point of less than 200°C.
4. The process of Claim 3, comprising the step of removing the first diluent prior to step (b).

5. The process of claim 1, wherein the Low MFR Catalyst is combined with the activated supported High MFR Catalyst in the substantial absence of additional activator.
6. The process of claim 1, in which the High MFR Catalyst comprises a cyclic bridged metallocene described by the following formula:



wherein A is a divalent group bound to each of L^A and L^B ; each of L^A and L^B are bound to M, and each Q is bound to M;

L^A and L^B are independently selected from the group consisting of cyclopentadienyl ligands and ligands isolobal to cyclopentadienyl, and substituted versions thereof;

wherein A is a divalent bridging group comprising a heterocyclic ring comprising from 3 to 6 carbon atoms and one silyl or germyl group, thus forming a 4 to 7 member divalent ring;

M is a Group 4 metal; wherein n 0, 1 or 2; and

Q is a monoanionic leaving group.

7. The process of claim 1, wherein the High MFR Catalyst is capable of producing polyethylene with an MFR of 40 or more when the High MFR Catalyst is the only catalyst present in a reaction mixture that includes ethylene monomers that are subjected to a gas phase polymerization in the presence of the High MFR Catalyst.
8. The process of claim 1, wherein the High MFR Catalyst is capable of producing polyethylene with an MFR of 60 or more when the High MFR Catalyst is the only catalyst present in a reaction mixture that includes ethylene monomers that are subjected to a gas phase polymerization in the presence of the High MFR Catalyst.
9. The process of claim 1, wherein the Low MFR Catalyst is a metallocene capable of producing polyethylene with an MFR of less than 45 when the Low MFR Catalyst is the only catalyst present in a reaction mixture that includes ethylene monomers

that are subjected to a gas phase polymerization in the presence of the Low MFR Catalyst.

10. The process of claim 1, wherein the Low MFR Catalyst is capable of producing polyethylene with an MFR of less than 40 when the Low MFR Catalyst is the only catalyst present in a reaction mixture that includes ethylene monomers that are subjected to a gas phase polymerization in the presence of the Low MFR Catalyst.
11. The process of claim 1, wherein the Low MFR Catalyst is a metallocene capable of producing polyethylene with a melt strength (MS) of 6 or more.
12. The process of claim 1, wherein the Low MFR Catalyst comprises a bridged metallocene compound described by the following formula:



where R^1 and R^2 are each bound to E, and E is bound to each of L^A and L^B ; each of L^A and L^B are bound to M, and each Q is bound to M;

L^A and L^B are independently selected from the group consisting of cyclopentadienyl ligands and ligands isolobal to cyclopentadienyl, and substituted versions thereof;

wherein the R^1R^2E group forms a divalent bridging group, wherein E is silicon or germanium; wherein R^1 and R^2 are independently selected from the group consisting of C_1 to C_5 alkyls, C_6 to C_{10} aryls, and C_7 to C_{20} alkylaryls;

M is a Group 4 metal; wherein n 0, 1 or 2; and

Q is a monoanionic leaving group.

13. The process of claim 11, wherein E is silicon.
14. The process of claim 1, wherein the activator comprises methylaluminumoxane.
15. The process of claim 1, wherein the support comprises silica.

16. The process of claim 1, wherein the diluent is a blend of a mineral or silicon oil and a hydrocarbon selected from the group consisting of C₁ to C₁₀ alkanes, C₆ to C₂₀ aromatic hydrocarbons, C₇ to C₂₁ alkyl-substituted hydrocarbons, and mixtures thereof.
17. The process of Claim 16, wherein the diluent comprises from 10 to 100 wt%, by weight of the diluent, of mineral oil.
18. The process of Claim 1, wherein the molar ratio of the low MFR Catalyst metal center to high MFR Catalyst metal center ranges from 2:1 to 1:3.
19. The process of Claim 1, wherein the activated supported High MFR catalyst system and first diluent are heated from 25 to 150°C prior to combining the Low MFR Catalyst.
20. A process of producing bimodal polyethylene homopolymers or copolymers comprising combining ethylene and one or more C₃ to C₁₀ alpha-olefins in a single gas phase reactor with a activated mixed catalyst system; wherein the mixed catalyst system is prepared by:
 - (a) combining a High MFR Catalyst with an activator and a support to form an activated supported High MFR catalyst system; and
 - (b) combining
 - (i) a diluent comprising a mineral or silicon oil with the activated High MFR catalyst system to form a first support slurry; followed by combining a Low MFR Catalyst with the first support slurry; or
 - (ii) a diluent comprising a mineral or silicon oil and a Low MFR Catalyst to the activated High MFR catalyst system.
21. The process of Claim 20, wherein the High MFR catalyst is a cyclic bridged metallocene; the cyclic bridged metallocene characterized in that it is capable of producing polyethylene with an MFR of 50 or more when activated and is the only catalyst present in a reaction mixture that includes ethylene monomers and is subjected to a gas phase polymerization; and wherein the Low MFR catalyst is a

bridged metallocene; the bridged metallocene characterized in that it is capable of producing polyethylene with an MFR of less than 50 when activated and is the only catalyst present in a reaction mixture that includes ethylene monomers and is subjected to a gas phase polymerization.

22. The process of claim 20, wherein the activated supported High MFR catalyst system is formed by combining the components in (a) in a first diluent having a boiling point of less than 200°C.
23. The process of Claim 22, comprising the step of removing the first diluent prior to step (b).
24. The process of claim 20, wherein the Low MFR Catalyst is combined with the activated supported High MFR Catalyst in the substantial absence of additional activator.
25. The process of claim 20, in which the High MFR Catalyst comprises a cyclic bridged metallocene described by the following formula:



wherein A is bound to each of L^A and L^B ; each of L^A and L^B are bound to M, and each Q is bound to M;

L^A and L^B are independently selected from the group consisting of cyclopentadienyl ligands and ligands isolobal to cyclopentadienyl, and substituted versions thereof;

wherein A is a divalent bridging group comprising a heterocyclic ring comprising from 3 to 6 carbon atoms and one silyl or germyl group, thus forming a 4 to 7 member divalent ring;

M is a Group 4 metal; wherein n 0, 1 or 2; and

Q is a monoanionic leaving group.

26. The process of claim 20, wherein the High MFR Catalyst is capable of producing polyethylene with an MFR of 40 or more when the High MFR Catalyst is the only catalyst present in a reaction mixture that includes ethylene monomers that are subjected to a gas phase polymerization in the presence of the High MFR Catalyst.
27. The process of claim 20, wherein the High MFR Catalyst is capable of producing polyethylene with an MFR of 60 or more when the High MFR Catalyst is the only catalyst present in a reaction mixture that includes ethylene monomers that are subjected to a gas phase polymerization in the presence of the High MFR Catalyst.
28. The process of claim 20, wherein the Low MFR Catalyst is a metallocene capable of producing polyethylene with an MFR of less than 45 when the Low MFR Catalyst is the only catalyst present in a reaction mixture that includes ethylene monomers that are subjected to a gas phase polymerization in the presence of the Low MFR Catalyst.
29. The process of claim 20, wherein the Low MFR Catalyst is capable of producing polyethylene with an MFR of less than 40 when the Low MFR Catalyst is the only catalyst present in a reaction mixture that includes ethylene monomers that are subjected to a gas phase polymerization in the presence of the Low MFR Catalyst.
30. The process of claim 20, wherein the Low MFR Catalyst is a metallocene capable of producing polyethylene with a melt strength (MS) of 6 or more.
31. The process of claim 20, wherein the Low MFR Catalyst comprises a bridged metallocene compound described by the following formula:



where R^1 and R^2 are each bound to E, and E is bound to each of L^A and L^B ; each of L^A and L^B are bound to M, and each Q is bound to M;

L^A and L^B are independently selected from the group consisting of cyclopentadienyl ligands and ligands isolobal to cyclopentadienyl, and substituted versions thereof;

wherein the R^1R^2E group forms a divalent bridging group, wherein E is silicon or germanium; wherein R^1 and R^2 are independently selected from the group consisting of C_1 to C_5 alkyls, C_6 to C_{10} aryls, and C_7 to C_{20} alkylaryls;

M is a Group 4 metal; wherein n 0, 1 or 2; and

Q is a monoanionic leaving group.

32. The process of claim 30, wherein E is silicon.
33. The process of claim 20, wherein the activator comprises methylaluminumoxane.
34. The process of claim 20, wherein the support comprises silica.
35. The process of claim 20, wherein the diluent is a blend of a mineral or silicon oil and a hydrocarbon selected from the group consisting of C_1 to C_{10} alkanes, C_6 to C_{20} aromatic hydrocarbons, C_7 to C_{21} alkyl-substituted hydrocarbons, and mixtures thereof.
36. The process of Claim 1, wherein the molar ratio of the low MFR Catalyst metal center to high MFR Catalyst metal center ranges from 2:1 to 1:3.
37. The process of Claim 20, wherein the process is a slurry or gas phase process conducted at a temperature of from 50 to 120°C.
38. The process of Claim 20, wherein the process is a continuous fluidized bed gas phase process conducted at a temperature of from 60 to 120°C.
39. The process of Claim 20, wherein a bimodal polyethylene is isolated having a density of from 0.910 to 0.930 g/cm³; a melt index (I_2) of from 0.3 to 3 dg/min; a flow index (I_{21}) of from 10 to 150 dg/min; and a melt flow rate (MFR) of from 10 to 80.

40. A bimodal polyethylene having a density of from 0.910 to 0.935 g/cm³; a melt index (I₂) of from 0.3 to 3 dg/min; a flow index (I₂₁) of from 10 to 150 dg/min; and a melt flow rate (MFR) of from 10 to 80.
41. The bimodal polyethylene of Claim 40, produced in a single gas phase fluidized bed reactor.
42. The bimodal polyethylene of Claim 41, produced by combining ethylene and butene or 1-hexene with a supported activated mixed catalyst system.
43. The bimodal polyethylene of Claim 42, wherein the supported activated mixed catalyst system comprises an inorganic oxide support having an average particle size of from less than 50 micrometers; an alumoxane activator; a bridged zirconocene and a cyclic bridged zirconocene.
44. The bimodal polyethylene of Claim 43, wherein the inorganic oxide support has an average particle size of from less than 35 micrometers.
45. The bimodal polyethylene of Claim 43, wherein the supported activated mixed catalyst system is formed by first combining a cyclic bridged zirconocene, an alumoxane and an inorganic oxide support to form an activated, supported cyclic bridged zirconocene; followed by combining the activated, supported cyclic bridged zirconocene with a diluent selected from the group consisting of alkanes, aromatic hydrocarbons, mineral oils, silicon oils, and combinations thereof to form a first support slurry; followed by combining a bridged zirconocene with the first support slurry to form the supported activated mixed catalyst system.
46. The bimodal polyethylene of Claim 40, comprising two polyethylene components, wherein the I₂ of each polyethylene component is within 2 dg/min of one another.